WHAT IS CLAIMED IS

1. A wavelength division multiplexer for multiplexing optical input signals, the multiplexer comprising:

a plurality of wavelength converters, each of the wavelength converters receiving at least one optical input signal and an optical pump signal and outputting at least one output signal having a wavelength that is shifted relative to a wavelength of said at least one optical input signal; and

a coupler combining the output signals from the plurality of wavelength converters into a multiplexed signal.

2. The multiplexer of claim 1, wherein each of the wavelength converters receives a different one of the optical input signals and outputs one of the output signals to the coupler.

3. The multiplexer of claim 2, wherein each of the output signals has a different wavelength.

4. The multiplexer of claim 1, wherein the optical input signals include n optical input signals, and

wherein the plurality of wavelength converters includes:

(a) groups of wavelength converters configured so that each of the optical input signals passes through a unique set of (a) converters, where (a) and n are integers greater than 1.

5. The multiplexer of claim 4, wherein the (a) groups of wavelength converters include:

(a) groups of $n^{1/a}$ wavelength converters, a first group of the $n^{1/a}$ wavelength converters receiving the optical input signals and outputting wavelength-shifted output signals to a next group of the $n^{1/a}$ wavelength converters, where $(n^{1/a})$ is an integer greater than 1.

6. The multiplexer of claim 5, wherein each of the wavelength converters in the first group receives $n^{1-(1/a)}$ optical input signals and outputs $n^{1-(1/a)}$ wavelength-shifted output signals.

7. The multiplexer of claim 1, wherein each of the plurality of wavelength converters includes:

a nonlinear crystal receiving said at least one optical input signal and said optical pump signal.

8. The multiplexer of claim 7, wherein each of the plurality of wavelength converters further includes:

a filter connected to an output of the nonlinear crystal.

9. The multiplexer of claim 1, further comprising:

an amplifier connected to the coupler to amplify the multiplexed signal.

10. The multiplexer of claim 1, further comprising:

a plurality of pump lasers, each of the pump lasers being connected to one of the plurality of wavelength converters and outputting an optical pump signal having a unique wavelength.

11. The multiplexer of claim 1, wherein a frequency of said at least one output signal output by any of the wavelength converters is a constant multiple of a frequency of said optical pump signal minus a frequency of said optical input signals.

12. The multiplexer of claim 1, wherein the optical input signals have a common wavelength, and

wherein the wavelength of said at least one output signal is shifted relative to the common wavelength of the optical input signals

13. A method for wavelength division multiplexing in a system including a plurality of wavelength converters and a coupler, the method comprising:

receiving, by each of the wavelength converters, one or more optical input signals;

receiving, by each of the wavelength converters, an optical pump signal;

shifting, by each of the wavelength converters, a wavelength of the one or more optical input signals based on a wavelength of the optical pump signal to produce one or more shifted output signals; and

combining the shifted output signals into a combined signal by the coupler.

14. The method of claim 13, further comprising:

filtering unwanted wavelengths from the shifted output signals.

15. The method of claim 13, further comprising:

amplifying the combined signal to produce an amplified signal; and

inputting the amplified signal into an optical fiber.

16. The method of claim 13, wherein each shifted output signal has a different wavelength.

17. The method of claim 13, wherein the system includes:

n wavelength converters, and

wherein the receiving one or more optical input signals step includes:

receiving a different one of n optical input signals by each of the n wavelength converters.

18. The method of claim 13, wherein the system includes:

(a) interconnected groups of $n^{1/a}$ wavelength converters, where (a) and ($n^{1/a}$) are both integers greater than 1, and

wherein the receiving one or more optical input signals step includes:

receiving n optical input signals by a first group of $n^{1/a}$ wavelength converters.

19. The method of claim 18, wherein the receiving one or more optical input signals step includes:

receiving $n^{1-(1/a)}$ optical input signals by each wavelength converter of the first group.

20. The method of claim 13, wherein the shifting includes:

shifting a common frequency of each of the optical input signals to a constant multiple of a frequency of said optical pump signal minus a frequency of said each optical input signal.

21. The method of claim 13, wherein each optical pump signal has a different wavelength from each other optical pump signal.

22. A wavelength division multiplexer for multiplexing n optical input signals, where n is an integer greater than 1, the multiplexer comprising:

a first group of wavelength converters receiving the n optical input signals and outputting n wavelength-shifted output signals;

a second group of wavelength converters receiving the n wavelength-shifted output signals from the first group and outputting n second output signals, each of the n second output signals having a unique wavelength; and

a coupler combining the second output signals from the second group of wavelength converters into a multiplexed signal,

wherein each of the wavelength converters in the first and second groups receives m input signals and outputs m output signals having wavelengths that are shifted relative to wavelengths of the m input signals, where m is an integer.

23. The method of claim 22, wherein each of the wavelength converters in the second group is coupled to a plurality of different wavelength converters in the first group, so that each of the n second output signals has passed through a unique pair of wavelength converters.

24. A wavelength division multiplexer for multiplexing n optical input signals having a common wavelength from one or more network devices, where n is an integer greater than 1, the multiplexer comprising:

n wavelength converters, each of the wavelength converters receiving one of the n optical input signals and an optical pump signal and optically generating one output signal having a wavelength that is shifted relative to the common wavelength by a different amount from wavelengths of other ones of the output signals; and

a coupler combining the output signals from the n wavelength converters into a combined signal.

25. A wavelength division multiplexer for multiplexing n optical input signals having a common wavelength from one or more network devices, where n is an integer greater than 1, the multiplexer comprising:

n wavelength converters, each of the wavelength converters receiving one of the n optical input signals and an optical pump signal and optically generating one output signal having a wavelength that is shifted relative to the common wavelength by a different amount from wavelengths of other ones of the output signals; and

a coupler combining the output signals from the n wavelength converters into a combined signal,

wherein each of the wavelength converters includes:

a nonlinear crystal receiving said one input signal and said optical pump signal and optically shifting the wavelength of said one input signal to produce an intermediate signal, and

a filter connected to an output of the nonlinear crystal to filter the intermediate signal and produce said one output signal.

26. A wavelength division multiplexer for multiplexing optical input signals from one or more network devices, the multiplexer comprising:

a first group of wavelength converters, each of the wavelength converters in the first group receiving a plurality of the optical input signals and an optical pump signal and optically generating a plurality of first output signals each having a wavelength that is shifted based on a wavelength of the pump signal;

a second group of wavelength converters, each of the wavelength converters in the second group receiving at least one first output signal from each of the wavelength converters in the first group and an optical pump signal and optically generating a plurality of second output signals each having a wavelength that is shifted based on a wavelength of the pump signal; and

a coupler optically coupled to the second group of wavelength converters to combine its input signals into a combined signal.

27. A method for wavelength division multiplexing in a system including n wavelength converters and a coupler, the method comprising:

receiving, by each of the n wavelength converters, one optical input signal;

receiving, by each of the n wavelength converters, an optical pump signal;

shifting, by each of the n wavelength converters, a wavelength of the one optical input signal based on a wavelength of the optical pump signal to produce one wavelength-shifted output signal; and

combining the wavelength-shifted output signals into a combined signal by the coupler.

28. A method for wavelength division multiplexing in a system including at least two groups of wavelength converters and a coupler that is optically coupled to the groups of wavelength converters, the method comprising:

receiving, by each of a first group of wavelength converters, a plurality of optical input signals;

receiving, by each of the first group of wavelength converters, an optical pump signal;

shifting, by each of the first group of wavelength converters, a wavelength of the plurality of optical input signals based on a wavelength of the optical pump signal to produce a plurality of first output signals;

receiving, by each of a second group of wavelength converters, at least one first output signal from each one of the converters in the first group;

receiving, by each of the second group of wavelength converters, an optical pump signal;

shifting, by each of the second group of wavelength converters, a wavelength of the at least one first output signal based on a wavelength of the optical pump signal to produce a plurality of second output signals; and

combining the second output signals into a combined signal by the coupler.

29. A wavelength division multiplexing system for transmitting n optical input signals, where n is an integer greater than 1, the system comprising:

n wavelength converters, each of the wavelength converters being configured to receive one of n optical input signals having a common wavelength and an optical pump signal and to optically generate one output signal having a wavelength that is shifted relative to the common wavelength by a different amount from wavelengths of other ones of the output signals;

a coupler to combine the output signals from the n wavelength converters into a combined signal;

an optical fiber to carry the combined signal; and

a splitter receive the combined signal from the optical fiber and to produce the n output signals, each having a wavelength that is shifted relative to the common wavelength by a different amount from wavelengths of other ones of the output signals.

30. A network, comprising:

one or more network devices selected from the group consisting of switches, routers, and add-drop multiplexers, the devices being configured to produce n optical input signals with a common wavelength, where n is an integer;

a wavelength division multiplexing system configured to receive the n optical input signals and to remotely deliver n optical output signals with different wavelengths, the system including:

a plurality of wavelength converters, each of the wavelength converters being configured to receive a plurality of the n optical input signals and an optical pump signal and to optically generate a plurality of the n optical output signals, each optical output signal having a wavelength that is shifted relative to the common wavelength by a different amount from wavelengths of other ones of the output signals; and

one or more other network devices selected from the group consisting of switches, routers, and add-drop multiplexers, the devices being configured to receive the n optical output signals with different wavelengths.